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(See article on Unwanted Weeds, page 426)

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AND THE SCIENCES SUPPORTING PUBLIC HEALTH

Since 1825

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CONTENTS

Editorial:

Trade Barriers and Our Foreign Drug Markets 420

Articles:

2,4-D Toxicity I; Toxicity Towards Certain Species of Fish. By J. W. E. Harrisson and E. W. Rees 422

Unwanted Plants in the Kilmer Botanical Garden. By T. P. Haas 426

New Galenical Preparations from Flax Seeds. By R. K. Aliev translated by E. Y. Allen 439

Book Reviews 445

Index to Volume 118 447

E D I T O R I A L

TRADE BARRIERS AND OUR FOREIGN DRUG MARKETS

AMERICAN drug manufacturers are intensely interested in the development of foreign markets and, in truth, without them much of the current program of plant expansion in the drug industry will eventually demand retrenchment. Since foreign markets are quite essential for the continuation of our industrial prosperity not only in pharmacy but also most other fields it would be wise for us to consider a most fundamental principle of economics which if ignored will most certainly destroy our potential sales abroad and in South America.

It does not require a trained economist to appreciate the basic fact that when we sell we want *American dollars* for our products and not foreign currency unless it can be exchanged for the number of dollars representing the value of the goods sold. Behind this fact, however, lies a situation commonly overlooked even by most politicians who should know better. How can these American dollars get into the hands of our prospective buyers? The answer to this question is almost always unpopular for it can only happen in three ways: we must give them away, loan them, or buy an equivalent amount of goods and services from the recipient. There is no other way that is legal.

Of these three ways the first two, although sometimes necessary as temporary expedients, are ridiculous as long term arrangements. The money which we give or loan foreign governments to buy our products is obtained from the people by taxation, and history has proven that large loans frequently have a habit of gradually acquiring the status of a gift. Few Americans are sufficiently altruistic to be willing to labor diligently, as does the bee, in order to provide for others without recompense. This is not the worst part of such a practice. The real tragedy is that we give or sell to others for paper credits our limited supply of natural resources in the form of manufactured goods without replacing them with more raw material. The United States, although still a comparative land of plenty, has spent its natural resources in a most reckless fashion. Much of our once

plentiful ore, wood, oil and coal has felt the pinch of exorbitant demand and in some places we are faced with a dwindling supply. We ourselves are fast becoming a "have not" nation and America's success as a nation has been due more to its abundance than to superior intellect on the part of its citizens.

Buying goods and services from other countries is the only sensible way to maintain international trade on a sound basis but invariably this causes bitter objections by those who produce similar goods domestically. They immediately clamor for restrictive tariffs which effectively bar the importation of such products. By this tariff barrier we then prevent the only means of enjoying international trade that is in any sense economically sound. Those who oppose this theory point to the high standard of living in the United States with its high wages and argue that it is impossible for us to compete with foreign labor. In a sense this is true but we have no real argument for barring foreign raw materials since this is a means of conserving our own. Neither is it justifiable to protect high cost producers in the United States where selling prices make it impossible for the people generally to possess or enjoy such products. During the war we had a severe meat shortage which might well have been alleviated but for the restrictions on Argentine beef; restrictions that are excused on the basis of hoof and mouth disease even though dressed beef cannot convey the disease to cattle. The restrictions are actually the result of farm lobbying just as are many other artificial trade barriers the result of action by pressure groups on Congress.

In establishing tariffs the real answer should be in whether the exercise of free trade raises the overall standard of living of our people and also whether it helps establish world order and prevent economic chaos in the countries of our neighbors. In some instances it may be a much lesser evil to work a minor economic hardship on a few of our citizens by free trade than to risk the rebirth of intense nationalism, trade barriers, economic upheavals and finally war. One war like the one just ended cost our country more in four years than has been saved by tariffs since the founding of our republic.

For those who are completely disinterested in world unity and friendship, being motivated solely by self interest, there is the final and inescapable argument that we cannot sell to others unless we also buy.

L. F. Tice

2,4-D TOXICITY-I*

Toxicity Towards Certain Species of Fish

By Jos. W. E. Harrisson and Edward W. Rees **

IN determining the value of an herbicide, other factors than that of toxicity to undesirable plants must be considered. Invariably, there are accompanying problems which must be satisfactorily solved or, at least, evaluated, before complete acceptance of a new material. Recently, there have been interesting herbicidal properties attributed to 2,4-dichlorophenoxyacetic acid (1). These have been accurately determined by many investigators (2, 3, 4, 5, 6, 7, 8, 9, 10). However, a search of the literature has revealed few studies of the effects of 2,4-D upon animal or fish life. Further, in view of recent reports of the use of 2,4-D to eradicate the water hyacinth (12) and its use against other emergent weeds (2), it would appear to be important also to determine its toxicity to fish life living in and about the vicinity of its application.

2,4-D is a chemical which, when applied to plants in very dilute concentrations, acts as a plant hormone, and which, when applied in relatively high concentrations acts as an herbicide. It is prepared by the reaction of phenol, halogenated acetic acid, and sodium hydroxide, followed by purification procedures. Other methods of preparation may be in use. For use as a plant hormone or as an herbicide, it must be produced in a relatively pure state, because of possible undesirable side effects of contaminating substances.

Some manufacturing procedures for preparing 2,4-D result in a product containing considerable 2,4-dichlorphenol or ortho monochlorphenol. Both of these materials have a high taste factor, one that could easily contaminate an entire drinking water supply. Their absence is therefore desirable. Furthermore, products of irregular purity may show variable toxic manifestations upon fish life.

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* Part of a research program grant by American Chemical Paint Co., Ambler, Penna., who supplied the 2,4-D in dry form containing 94% of 2,4-D and 6% of organic dispersal agent.

** LaWall and Harrisson, Research Consultants, Philadelphia, Penna.

Early tests demonstrated that sprays containing 500 to 1000 parts per million were effective in herbicidal action on weeds of certain kinds. Hildebrand (12) successfully killed the growth of the water hyacinth in waterways of Florida with sprays of this strength. Emergent weeds in a reservoir in California were successfully treated in the same manner (13). In spraying weeds and other plants which grow in waterways, it is necessary to bear in mind that there will be considerable dilution of the herbicidal spray by the water itself. Thus, fish inhabiting the waterway will probably be exposed to a much lower concentration of the herbicide than the spray dilution would indicate. Therefore, testing the effect of a herbicide on fish in the dilution to be used in spraying will indicate the maximum possible exposure and one which is unlikely to be attained in actual practice in the waterway treated.

These experiments were conducted upon the following species because they represent some of the common fish found in the Eastern United States:

(1) Goldfish—Cassarius auratus
(2) Sunfish (bream)—Eupomotis gibbosus
(3) Catfish (bullhead)—Ameiurus nebulosus
(4) Minnow (killifish)—Cyprinodontidae family

The tests were set up in tanks in which the quantity of water per individual fish was approximately one gallon. The water was kept at 20-25° C. and aerated by means of circulating water pumps. The size and weight of the fish at the time of the test is given in the following table:

Species	*Size in length*	*Weight*
(1) Goldfish	2 -3 inches	5 grams
(2) Sunfish	2.5-4 inches	5 grams
(3) Minnows	1.5-2.5 inches	1.5 grams
(4) Catfish	5 -6 inches	85 grams

In Table I data are given indicating the expected orientation of the 2,4-D relative to its probable toxicity. Based upon these preliminary tests a new series was run maintaining control groups under the same environmental conditions and the results are tabulated in Table II.

TABLE I

Deaths in seven days
(No control group)

2,4-D Concentration	Goldfish	Minnows	Sunfish
10 ppm	2/4	0/4	0/4
100 ppm	3/4	0/4	1/4
1,000 ppm	0/4	1/4	3/4
10,000 ppm	4/4	4/4	4/4

TABLE II

Deaths in seven days
(With control group)

2,4-D Concentration	Minnows	Sunfish	Catfish
500 ppm	0/14	0/14	
1,000 ppm	0/14	6/14	4/20
1,500 ppm	0/14	14/14	
2,000 ppm	4/14	14/14	3/20
2,500 ppm	14/14	14/14	18/20
3,000 ppm			20/20

Observations were not repeated upon goldfish as these were difficult to obtain and, furthermore, they had an erratic and high death rate without being exposed to 2,4-D.

During the period of the test, namely, seven days, no deaths occurred in the control groups. The safe maximum non-toxic level of 2,4-D under the conditions of testing is, for minnows, 1500 ppm; sunfish, 500 ppm; and is estimated for catfish to be 500 ppm.

In considering the overall toxicity or unfavorable effect upon fish life following the use of 2,4-D, a number of factors are to be evaluated. However, the actual toxicity level of 2,4-D in a short exposure period is likely to be well within a safe range. This is on the assumption that sprays of a concentration not exceeding 1000 ppm are effective for killing emergent weeds, and further, that the use of a spray of this concentration of 2,4-D on the weeds will give an actual concentration in the waterway below 1000 ppm. Additional side-effects upon fish life would be concerned with the reduction of oxygen due to decomposition of destroyed weeds, and the effect of

low concentration of 2,4-D upon lower forms of life upon which the fish feed. The first will reduce the available oxygen far below a safe level and the latter will create a nutrition problem. No information is at present available as to these factors and they should be considered further.

Summary

The LD_{50} concentration of 2,4-D for minnows is approximately 2000 ppm; for sunfish, 1000 ppm; and for catfish, 2000 ppm. The upper safe limit for minnows is 1500 ppm; sunfish, 500 ppm; and estimated to be about 500 ppm for catfish. These figures are applicable under the conditions of testing and refer solely to a seven day exposure period during which the concentration of 2,4-D was kept at a fixed level.

Acknowledgment

Appreciation is expressed for the cooperation extended by C. A. French, Commissioner, and C. R. Buller, Chief Fish Culturist of the Pennsylvania Board of Fish Commissioners, and John J. Wopart, Superintendent, State Fish Hatcheries, Holmesburg, Pennsylvania, through whom many of the fish were obtained.

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UNWANTED PLANTS IN THE KILMER BOTANICAL GARDEN.

By Theodor P. Haas, Ph. D.*

IN our Kilmer Botanical Garden we do our best to raise drug plants for demonstration purposes for the students of the Philadelphia College of Pharmacy & Science. We have to take great care of these plants, and we do everything to keep them thriving under the very difficult conditions prevailing in the garden. We are surrounded by factories which contaminate the air. We have to keep the struggle for existence away from our cultivated plants, as much as we can.

But we have in our garden still other plants, plants which we do not want, plants which we call "weeds." In general, the word "weed" means a plant which is not desired by man; therefore it has an anthropocentric significance. But this word has also a relative meaning. A plant may be considered very nasty in one country, but very desirable in another. For instance, we have in the Kilmer Botanical Garden Coltsfoot, *Tussilago Farfara* L., which grows abundantly in Middle-Europe even on gravel and waste places. It grows, for instance, upon the rubble of bombed areas, a fact which was stated** recently in Le Havre, France. Here in Philadelphia, we have trouble keeping the plants alive in summer, and probably our garden is the only place around Philadelphia where the plant may be seen; however it is naturalized farther north in the U. S. On the other hand, the author at one time observed the cultivation in the Munich Botanical Garden of *Lobelia inflata,* the Indian tobacco, as a drug plant, whilst around Philadelphia it is a fall weed. We cultivate it in our Kilmer Botanical Garden, but late in the season it spreads out all over the garden.

It is often difficult to cultivate certain plants on the spot where we want them. We have, in our garden, drug plants—also native

* Department of Biology, Philadelphia College of Pharmacy and Science.

** M. Debray and P. Senay: "La flore des ruines du Havre," *Bulletin de la Societé Botanique de France,* XII, 1945.

ones—which seminate themselves in places where they do not belong, and grow there better than in their correct place. This problem is acute especially in Alpine gardens in the mountains, where it is often very difficult to keep the plants in the beds to which they belong. The next step is that the plants escape a garden and become "garden fugitives." When such a "garden fugitive" finds favorable conditions outside, it also may become a "weed." An example of this is the Japanese Honeysuckle, *Lonicera japonica,* which was introduced from Japan to Philadelphia in 1876 at the Centennial Exhibits in Fairmount Park. The plant escaped, spreading out all over the country, frequently suppressing the native vegetation. Though the flowers have a wonderful sweet scent, the plant is considered as a "weed."

Weeds can be very pretty. Later in the season there appears a little vine, a morning glory, *Ipomoea hederacea,* a native plant of the tropical America and closely related to the sweet potato, *Ipomoea Batatas.* It has beautiful purple flowers, blooming in the forenoon, but wo do not want the plant. The dayflower, *Commeline vulgaris,* which came from Asia, has beautiful blue flowers, but it is a "weed" also!

In this article we shall consider only flowering plants. Among the weeds there are also mosses and liverworts. Of the latter we find *Marchantia polymorpha;* we do not have it in the Kilmer Botanical Garden, but the writer of these lines found in a North Philadelphia backyard, between the paving stones, a small *Riccia.* Strangely enough, among the weeds there is not a single representative of the *Gymnospermae.*

When man tries to protect the cultivated plants in the struggle for existence, the weeds fight against man and defend their existence with great tenacity. Very often the weeds are victorious. The weeds are very interesting plants indeed! They have a very wide range of living abilities—much wider than the cultivated plants. They can live on soils which are not suitable for the cultivated plants. Yet it is strange that it is nearly impossible to replant many weeds which were taken out of the place where they grew before. Many weeds are very sensitive towards damage to the root system. A very high osmotic pressure inside the plant allows the weeds to take out water from dry and sterile soils, but the root-system has to be intact. Weeds, when cut off or removed from the ground, wilt very

quickly. All weeds have these properties in common without any regard to which family the particular plant belongs.

What enables the weeds to resist so successfully man's efforts to destroy them? There are mainly two things which the weeds possess to defend themselves. The subterranean system and the propagation give the weeds the ability to resist man's effort to exterminate them. The former is especially important for perennials among the weeds. Many of them have stolones, aerial or subterranean runners, deep taproots, etc., and they also have the ability to regenerate lost parts. When we decapitate a dandelion, after a while new plants appear above the ground. In many cases the semination is replaced by the runners previously mentioned. Other weeds have very small flowers and the ripening of the fruits and seeds escapes our attention. For instance, the flowers of the crab grass, *Eleusine indica,* are very small, smaller than the average grass flowers. The fruits of this grass are also very small (whether this grass is self pollinated, as many other grasses, is unknown) and are distributed by wind, like dust.

Among the weeds are many species which bloom only once, and die after producing fruits. We call such plants "hapaxanthic." We do not use the word "annual," because there are plants which live for many years until they come to bloom, and then they die after the ripening of their fruits. We have such plants among the palms (e. g. *Corypha*), and the *Agave americana* also belongs to them. Among the weeds are many "hapaxanthic" plants whose vegetation period starts in spring and ends in fall. We have among them also others which need two years. They are called "biennials," but they are also "hapaxanthic" plants. They produce in the first year a rosette of leaves and they bloom the following year. (This process is ruled by hormones.) They die then, after the ripening of their fruits. The evening primrose, *Oenothera biennis,* is such a plant. Among the "hapaxanthic" plants are some with a shorter life period than a year. Among the weeds are many which produce several generations in one year. Parallel with this goes a tremendous production of fruits and seeds, and this is the other weapon with which the weeds fight for their existence. In Ithaca, N. Y., it was stated that a single plant of *Solanum nigrum,* the black nightshade, had produced 178,000 seeds, and *Erigeron canadensis,* bitterweed, 243,375

seeds (specifically, one-seeded fruits). In Europe it was found that *Galinsoga parviflora,* a native of Peru, present in Europe as a weed since the beginning of the 19th century, has 2 to 3 generations in one year; a strong plant—it is a composite—it produces 36 to 38 fruits per head and about 300,000 fruits as a whole. It takes about 4 weeks until a germ plant produces the first flower, and the fruits retain their germination power for 1 to 2 years. *Galinsoga parviflora* was cultivated in 1794 in the botanical gardens of Madrid and Paris and escaped, perhaps, from the latter; it is sometimes named "French Weed." It is quite possible that the plant was introduced to this country via Europe. These three plants grow in our Kilmer Botanical Garden!

Another fact is also striking. In Philadelphia during the summer tropical conditions prevail to a greater or less extent. This enables us to keep outdoors a number of greenhouse plants from May until nearly November. But this fact also permits tropical weeds the possibility of living with us during these months. These tropical weeds are mostly hapaxanthic plants which pass the winter in the form of fruits and seeds. The winter cold is not able to kill them. It is even possible to keep the seeds of the tropical sensitive plant *Mimosa pudica* alive outdoors in the ground during the winter.

Tropical conditions in Philadelphia! This leads to the question, where do our weeds come from and especially where do the weeds in the Kilmer Botanical Garden come from? This is a very interesting question, a question which is connected with the problem of how plants travel. Is it not strange that plants should travel, the plants which are rooted in the soil? Yes, the plants do travel and they travel very great distances. First of all, fruits and seeds can travel. Some plants have means of throwing their ripe fruits or seeds away. We have juicy fruits which are explosive. We have "touch me nots," *Impatiens* species whose ripe fruits explode when touched. The Mediterranean squirting cucumber *Ecballium Elaterium* which has an internal pressure of nearly 25 atmospheres, can throw the hard seeds approximately ten meters. The dry splitting fruits, the regmas of the tropical sandwich tree, *Hura crepitans,* are thrown still farther away.

But much larger distances are passed if foreign means are used, such as wind, water or animals. The fruits and seeds of these plants

are marvellously adapted to each kind of distribution. If they are transported by wind then they are either very small, like dust, or possess structures to be airborne, e. g., the fruits of the dandelion are parachutists, the winged fruits of maple trees work like a propeller; by these means the fall velocity is decreased and there is the possibility that the wind may carry the fruits away. If the fruits are distributed by animals, they may be either juicy in order to be eaten, or dry and spiny to be carried outside of the animal, on the fur. In the first case the fruits assume a conspicuous color when they are ripe; before that time they do not differ from the color of the foliage. Birds take plants with them on their wide travels, either by eating the fruits (such fruits are mostly red, since birds see red best, like we do), or, in the case of water-plants, very often with the dirt of their feet.

Ocean currents constitute a great agency for the distribution of fruits and seeds. Many fruits have a waterproof surface and contain air, so they remain buoyant for a long while. Connected with this adaptation is a long lasting germination power. We know that fruits of the tropics are transported by the ocean currents to the Arctic. The coconut is extremely well adapted to ocean travels, yet it was man who distributed the plant so widely, because it is an important foodplant. It is a plant of the Pacific and was brought by the white man in the 16th century to the Atlantic Ocean.

All these means of travel do not answer the problems with which plant geography is faced. We often have highly specialized families distributed over the whole globe. The *Droseras* (sundews) and the *Utricularias* (bladderworts) are little carnivorous plants with highly developed shoots and leaves with which they catch their prey, and these complicated organs are seen in all the representatives of these families in the same way whether we find them in India, in the tropics of South America, in Australia, or in this country.

When people wandered in the early times they took with them their most important food plants, either in the form of fruits and seeds, or when possible, also as tubers and bulbs. Herodotus tells us that the Phoenicians who sailed around Africa at the time of the Pharaoh Necho (600 B. C.), had wheat (specifically Emmer, *Triticum dicoccum,* the wheat of antiquity with the chromosome number $2x = 28$) with them. They planted it in South Africa, waiting there

for the ripening of the crop. Having repaired their boats during this time, they continued their journey after the harvest. The South Asiatic banana was taken across the African continent by slaves in the form of the tubers (the tubers remain moist for a long time) and found in West Africa by the Portuguese. The Greeks became acquainted with the banana (and also with the sugar cane) on the occasion of the expedition of Alexander the Great to India (300 B. C.); the Romans knew also of it (Pliny), but the knowledge of the plant was lost. That the American Indians, who came probably from Asia across the Bering Strait, brought no Old World food plants like millet, wheat or rice, with them may indicate that they were hunters and fishers!

But man takes with him not only the plants he wants, but also ones which he does not want, the weeds! This is very interesting; we can observe this fact even today. When one goes into the New Jersey pine barrens and visits a habited place he always finds some weeds such as poke weed, ragweeds, or some members of the goosefoot family, like *Chenopodium album,* the pigweed, and a few other plants which are not native there. This is the case even in the interior of that vast, sparsely populated area!

Concerning the travelling of the weeds we have generally no records. When the writer of this article saw in "Life Magazine" a picture of American soldiers in North Africa, together with American *Opuntia* cacti, it was impossible for him to find the date of this "American invasion of the Old World." Such American Opuntias were even observed in the interior of Asia near the Thibetan-Chinese frontier by the second Dolan Expedition of the Academy of Natural Sciences in Philadelphia (1934-36). These plants were more than 2,500 miles from the Chinese coast and completely isolated from any Western civilization. The same fact has been stated by Wilson*: "In the Tung Valley between 4,000 and 5,000 feet altitude a 'Prickly Pear' (*Opuntia Dillenii*) has become naturalized. This American colonist has made itself very much at home, covering many miles of barren rocky slopes." The American agave, *Agave americana,* naturalized now in Italy as far north as Merano and Bolzano on the south edge of the Alps, came to that

* Wilson, Ernest Henry: "A Naturalist in Western China," p. 154. London, 1913.

country in 1561. The story of *Galinsoga parviflora* has already been related; another cosmopolite among the weeds is *Erigeron canadensis,* the bitterweed. It was mentioned first in 1655 as existing in a botanical garden in France, but it probably came to Middle Europe from the Mediterranean in the 18th century. Linnaeus speaks of the American origin of that plant and its wide distribution in South Europe. It looks as if the weeds would form an "international underground organization" and, when they are discovered, they would cynically say: "Yes, I am here!" We shall see that the weeds really are an "international society." We might say: "The cultivated plants travel with the will of man, the weeds travel against the will of man!"

Some weeds have travelled together with cultivated plants for many thousands of years, their fruits and seeds ripening together and not separable. In the rye and wheat fields of Middle Europe there is a certain group of weeds called "archaeophytes." To them belong the red poppy *Papaver Rhoeas,* the blue student button or corn flower, *Centaurea cyanos,* the corn cockle, *Agrostemma Githago,* and others. In oat fields we find the hemp nettle, *Galeopsis Tetrahit.* (The name "corn" has no relation to our corn or maize. In German "corn," or better "Korn," means rye, the main cereal in Germany.) Only corn cockle and hemp nettle reached North America as weeds. The "archaeophytes," which are believed to have the same origin as the cereals which they accompany and with which they travel, find, in general, suitable living conditions only in these cereal fields, and they disappear after a while when the locality is used for other purposes. As far as we know no "archaeophytes" travel with maize. It is much easier to keep the large grains free of weed seeds.

From the viewpoint of the plants, we can say: "The weeds travel with intention!" Under these circumstances we may understand that today the weeds have a wide distribution, and many are cosmopolites. The writer of this article has read a recent paper * published in India concerning weeds which were found on the grounds of the Hindu University in Benares. There were recorded twelve weeds which occur also in and around Philadelphia. In the bombed

* "An Ecological Study of the Vegetation of the Benares Hindu University Grounds," by R. Misra, *The Journal of the Indian Botanic Society,* Vol. XXV, No. 2, May, 1946.

area of Le Havre in France, according to the article previously mentioned, there are eighteen which grow in the Philadelphia area. These are *cosmopolitan weeds* or *international weeds* or *World weeds;* we find them throughout the whole world where they find suitable living conditions. Besides these world weeds which occur in all countries, a larger or smaller number of *Local weeds* exist. These are weeds which are native to that particular country and find only there the necessary living conditions. Among world weeds are, for instance, *Chenopodium album, Galinsoga parviflora,* and *Erigeron canadensis;* local weeds in this country are *Lepidium virginicum* (pepper grass) and *Eupatorium rugosum* (white snakeroot). In Le Havre there are *Urtica urens,* a European nettle, *Mercurialis annua,* a European member of the spurge family (*Euphorbiaceae*), which are such local weeds, whilst we have in India for instance *Corchorus acutangularis,* a relative of *Corchorus capsularis* the Jute, belonging to the linden family (*Tiliaceae*) as a local weed. In Benares and also in Le Havre the world weeds make up about 10 per cent of all recorded weeds, but a strong separation between the latter and local weeds is impossible. We, in this country, have imported many weeds from Europe which are not to be considered as "world weeds"!

What is the origin of the weeds in the Eastern United States? According to Dr. John M. Fogg's statement (John M. Fogg, Jr.: "Weeds of Lawn and Garden," University of Pennsylvania Press, Philadelphia, Pa., 1945), there are:

53% of all weeds from Europe or Eurasia
32.5% of all weeds from North America
8% of all weeds from Eastern Asia or India
5.5% of all weeds from tropical America
1% and less from Africa

We mentioned some dates indicating the arrival of American plants in Europe, but in general we have no records when foreign weeds came to this country. Working with our Martindale Herbarium, we stated that many weeds came to the Eastern United States as ballast plants from ships.* The ships contained dirt in

* T. P. Haas, "The Martindale Herbarium Fifty Years in the Possession of the Philadelphia College of Pharmacy and Science," *American Journal of Pharmacy, 116,* 420 (1944).

order to stabilize them during the crossing of the ocean. This dirt was taken from the neighborhood of the ports where they started their journey, and included also fruits and seeds of weeds of those areas. This dirt was thrown out again on so-called "ballast grounds" in the vicinity of the American harbors where they arrived. On their way back to Europe the ships used machines or food as ballast. We had such "ballast grounds" near Philadelphia and Camden (they are now covered by streets), New York and the opposite bank of the

FIGURE 1. *Mazus japonicus.*

Hudson and the East River, and near Boston and Baltimore. From these "ballast grounds" weeds may have spread out. During the 70's and 80's of the last century, and also during the Civil War, Martindale and his friends did much research work in this field. The majority of the boats came from Europe at that time and this may be a hint as to why so many weeds originate from Europe. During World War I dirt ballast again came from Europe; the Academy of Natural Sciences in Philadelphia has done research work on this. In World War II ships once more contained dirt

ballast, especially Russian boats, but investigations were impossible. We no longer have particular "ballast grounds." Some boats threw out the dirt before entering the rivers, and during the war the surroundings of harbors could not be visited because of military reasons. For this post-war period we have no new records about new weeds.

It is certain that many weeds followed the trade roads. We know that the cocklebur, *Xanthium spec.,* native in the Southern United States, came with the wool to Europe. In the neighborhood of railroad stations we sometimes find weeds as "adventitious plants." Thus, in Philadelphia, at N. 19th Street, a little slope of the street near the Pennsylvania Railroad Station is a locality where for several years has grown a hapaxanthic weed, *Plantago arenaria,* a native of South and Middle Europe. Since this is a drug plant, we collected some specimens from there and cultivated them in the Kilmer Botanical Garden. Many of the "ballast plants" disappeared again after a shorter or longer period, but many survived and are now members of the "international society" which weeds form today in our country and everywhere else.

During the season we fight in our Kilmer Botanical Garden about fifty different weeds, using the term in the sense of unwanted plants. On account of their medicinal value some plants which generally are considered as "weeds" are cultivated in the Kilmer Botanical Garden, and they are mentioned as such in the list of "our" weeds which now follows. The listed weeds originated in Europe, North America, tropical America, East and tropical Asia, including India, and we have a probable recent invader from Japan: *Mazus japonicus* (*Thunb.*) *Kuntze* (Fig. 1). (The oldest specimen in the local herbarium of the Academy of Natural Sciences dates from 1918.) We have spring, summer and fall weeds. In our list of the plants which the writer of this article has observed for several years, we follow again Dr. Fogg:

List of the Weeds in the Kilmer Botanical Garden

43rd St., Kingsessing and Woodland Aves., Philadelphia, Pa.

Latin Name	*English Name*	*Family*	*Origin*	*When present* *
Cynodon Dactylon	Bermuda Grass	Gramineae	Palaeo-, Neotropis	VI/IX
Digitaria spec.	Finger Grass	Gramineae	Europe	VI/IX
Eleusine indica	Crab Grass	Gramineae	Trop. Asia, India	VI/IX
Panicum dichotomiflorum	Fall Panicum	Gramineae	N. America	VII/VIII
Poa annua	Low Spear Grass	Gramineae	Europe	whole season
Setaria verticillata	Bur Foxtail	Gramineae	Europe	V/VI
Cyperus strigosus	Sedge	Cyperaceae	N. America	VIII/IX
Commelina communis	Dayflower	Commelinaceae	Trop. Asia	VII/XI
Allium vineale	Wild Onion	Liliaceae	Europe	IX/XII
Polygonum aviculare	Comm. Notweed	Polygonaceae	Eurasia, N. America	V/XI
Polygonum longisetum	Bristly Lady's Thumb	Polygonaceae	Asia	VIII/XI
Rumex acetosella	Sheep Sorrel	Polygonaceae	Europe	VII/VIII
Rumex obtusifolius	Bitter Dock	Polygonaceae	Europe	whole season
Chenopodium album	Pig Weed	Chenopodiaceae	Europe	V/XII
Chenopodium ambrosioides, var. *anthelminticum*	Wormseed (also cult.)	Chenopodiaceae	Trop. America	VII/XI
Amaranthus hybridus	Amaranth	Amaranthaceae	Trop. America	IX/XI
Amaranthus retroflexus	Rough Pigweed	Amaranthaceae	Trop. America	IX/XI
Phytolacca americana	Pokeweed (also cult.)	Phytolaccaceae	N. America	VII/X
Mollugo verticillata	Carpet Weed	Aizoaceae	Trop. America, Africa	VII/IX
Arenaria serpyllifolia	Thyme-leaved Sandwort	Caryophyllaceae	Europe	whole season
Stellaria media	Chickweed	Caryophyllaceae	Europe	whole season
Portulaca oleracea	Purslane	Portulacaceae	Europe	VII/IX
Capsella Bursa-pastoris	Shepherd's Purse	Cruciferae	Europe	V/VI

Latin Name	*English Name*	*Family*	*Origin*	*When present* *
Lepidium virginicum	Peppergrass	Cruciferae	N. America	V/XI
Roripa sylvestris	Yellow Cress	Cruciferae	Europe	V/XI
Potentilla norvegica, var. *hirsuta*	Rough Cinquefoil	Rosaceae	Eurasia, N. America	VIII/XI
Trifolium repens	White Clover	Leguminosae	Eurasia, N. America	whole season
Oxalis europea	Sour Grass	Oxalidaceae	Europe	whole season
Euphorbia maculata	Creeping Spurge	Euphorbiaceae	N. America	VI/IX
Malva rotundifolia	Common Mallow	Malvaceae	Europe	VIII/IX
Rhus Toxicodendron	Poison Ivy	Anacardiaceae	N. America	shrub
Oenothera biennis	Evening Primrose	Onagraceae	N. America	fall (biennial)
Ipomoea hederacea	Ivy-leaved Morn'g Glory	Convolvulaceae	Trop. America	VIII/X
Verbena urticaefolia	White Vervain	Verbenaceae	N. America	VIII
Solanum nigrum	Black Nightshade	Solanaceae	Eurasia, N. America	VIII/XI
Datura Tatula	Purple Jimson Weed	Solanaceae	Trop. America	VIII/IX
Verbascum Blattaria	Moth Mullein	Scrophulariaceae	Trop. America	VIII, fall (biennial)
Mazus japonicus	.....	Scrophulariaceae	Japan	whole season
Veronica peregrina	Neckweed	Scrophulariaceae	N. America, Europe	VIII
Veronica serpyllifolia	Thyme-leaved Speedwell	Scrophulariaceae	N. America	VIII/XI
Plantago lanceolata	Narrow-leaved Plantain	Plantaginaceae	Europe	whole season
Specularia perfoliata	Venus'Looking-Glass	Campanulaceae	N. America	VIII
Lobelia inflata	Ind. Tobacco (also cult.)	Campanulaceae	N. America	IX/XI
Achillea Millefolium	Yarrow (also cult.)	Compositae	N. America	VII/XII
Ambrosia artemisiifolia	Common Ragweed	Compositae	N. America	VIII/IX
Bidens frondosa	Stick-tights	Compositae	N. America	fall
Erigeron canadensis	Bitterweed	Compositae	N. America	VIII/XI
Eupatorium rugosum	White Snakeroot	Compositae	N. America	IX/XI
Galinsoga parviflora	Galinsoga	Compositae	Trop. America	whole season

* Roman numerals indicate number of month when present.

These are the unwanted plants which are to be found during the year in the Kilmer Botanical Garden and the surrounding area. Some of them disappear in one year and come back in another. Some weeds bloom in spring, e. g., some grasses. Others have their vegetation period during the hottest months, June, July and August like *Euphorbia maculata* or *Molugo verticillata,* and especially *Eleusine indica.* Fig. 2, which depicts the latter, was taken on the

FIGURE 2. *Eleusine indica.*

sidewalk on the corner of South 8th and Spruce Streets in Philadelphia in about July, 1945; it grew between the paving stones. It is rather difficult to get rid of these tropical weeds. Then we have fall weeds, blooming in late August; *Eupatorium rugosum* is such a one. *Galinsoga parviflora* blooms from early summer until late into fall, until it is killed by frost. *Poa annua* and our little Japanese *Mazus japonicus* blooms during the whole season.

The weeds are in general inconspicuous, small plants, but though they are undesired and neglected by average people, their story is amazing; to trace their origin, we have traveled in fancy to many parts of the world from which they came as unwanted plants.

NEW GALENICAL PREPARATIONS FROM FLAX SEEDS

By R. K. Aliev

Translated from an article bearing the same title in Russian and appearing in the Russian Pharmaceutical Journal "Pharmatsia", 6, 1944.

By Edgard Yan Allen, M. Sc.

IN Hager's old handbook the use of flax seeds is indicated in the form of poultices for treating boils. Being interested in this, we set forth before us the problem of studying the phytochemical composition and preparation of an ointment and paste from flax seeds which could be used for the treatment of pyogenic infections of the skin. The raw material for this investigation was collected and obtained for us from the Astrakhan-Bazarsk region of the Azerbaijan Soviet Socialist Republic.

1. As a result of the phytochemical analyses performed, the following list of flax seed components was formed:

Glucoside Linamarin	1.50%
Sugary Substances of Hydrolysis	0.36%
Sugary Substances after Hydrolysis	6.60%
Cellulose	0.51%
Fatty Oils	from 25%-35%
Lecithin, Vitamin C	15.84 mg. %
Protein	up to 15.00%
Mucilage	4.81%

Traces of Vitamin A, gums, alkalies and alkaline earth metals, ferments (catalase and lipase).

2. Alkaloids, anthraglucosides, saponins, bitter substances, tannin-like substances, ethereal oils, Vitamins D and K were not found to be present.

3. In flax seeds there is found from 2.92% to 8.69% of ash and 1.00% acids: malic, lactic, oxalic, acetic.

4. From this list of substances found in flax seeds special attention should be given to ascorbic acid, Vitamin A and the glucoside linamarin.

We prepared the following galenical preparations from flax seeds:

1. An ointment, "Unguentum seminis Lini," according to the following formula:

Seminis Lini contusi (Contused Flax Seed)	20 Parts (By Weight)
Vaselini albi depurati (Purified White Vaseline)	80 " "
Olei Persicorum (Oil of Persic)	q. s.

Method of Preparation: Twenty (20) parts of powdered Linseed, which has been ground (contused) and screened through a Number 4 sieve, are thoroughly rubbed together (in a mortar) with a small amount of fresh vegetable oil (Persic, Almond Oil or any other fixed oil of this type). Then 80 parts of purified white vaseline are added and these ingredients are thoroughly mixed until a uniform mixture is obtained.

Regardless of the thoroughness of the mixing, one still sees the remains of the seed coats and various other parts of the flaxseed. In order to eliminate these the ointment is rubbed through a double or triple layer of gauze. The ointment prepared from linseed should have a bright brown color, a uniform thick consistency and a faint odor of flaxseed.

Upon continuous standing the ointment becomes rancid and as a result stops being an active medicinal preparation. Therefore, it is necessary to store the ointment in a dry, cold and dark place in well-filled, flat, closed porcelain or glass containers.

The ointment, when prepared for stock, should not stand for a long period of time. It is best to prepare it ex tempore.

NOTE: The following information in reference to a No. 4 sieve may be helpful to any pharmacist desiring to compound the above mentioned ointment:

Sieve No. according to Φ VII	No. 4
Threads per one square centimeter	18
Openings per one square centimeter of sieve material	324
Designation customary in foreign literature	M/18
Thickness of threads in millimeters	0.22 mm.
Usual width of mesh in millimeters	0.33 mm.
Sieve Material	Bronze (wire) Netting.
Designation of Powder:	Pulvis modicus Medium Coarse Powder.

2. Linseed Paste: "Pasta seminis lini" according to the following formula:

Ung. seminis Lini (Flax Seed Ointment)	100 Parts (By Weight)
Zinci oxydati (Zinc oxide)	10 " "
Amyli Tritici (Wheat Starch)	20 " "

Method of Preparation: Ten (10) parts of zinc oxide, which has been previously ground into the finest powder and sifted through a No. 1 sieve, are rubbed together with a sufficient (not large) quantity of flax seed ointment in a clean mortar. Then the twenty (20) parts of wheat starch (in finest powder) are added and also the remaining portion of the flax seed ointment. These ingredients are well mixed. The paste obtained in this manner has a light yellowish color, a thick uniform consistency, and is kept at room temperature in a well-closed jar. It is prepared ex tempore.

NOTE: The following information pertains to a No. 1 sieve as used in Russian pharmaceutical practice:

Sieve No. according to Φ VII	No. 1
Threads per one square centimeter	50
Openings per one square centimeter of sieve material	2500
Designation customary in foreign literature	M/50
Thickness of threads in millimeters	0.08 mm.
Sieve material	Silk Cloth
Usual width of mesh in millimeters	0.12 mm.
Designation of Powder:	Pulvis subtilissimus. Finest Powder.

The ointment and paste were experimented with in cases of suppurative skin disease. Investigations were made at the Azerbaijan Skin-Venereal Institute (Experimenter: Physician of Merit of the Azerbaijan Socialist Soviet Republic, Professor Eivazov) on forty-six cases involving furunculosis, carbunculosis, pyodermia of the skin and pus abscesses.

The ointment was spread on gauze material which was two to three layers in thickness. The top of this bandage was covered with a thin layer of cotton. The infected area was bandaged. The surrounding infected area of the skin was washed with alcohol or benzine. The furuncles present were not pressed out and the necrotic plugs were not mechanically removed. In impetigo infections the covering of the pustule or crust was first removed with pincers.

In furunculosis the suppurating action of the recommended ointment manifested itself first: a rapid change from the inflammatory infiltration to the dispersion of pus from the furuncles. Besides, marked evidences of inflammation were quickly allayed: the swelling of the skin surrounding the furuncles diminished and the redness due to inflammation started to fade; the malady of the infected areas diminished very markedly, as a rule, on the following day after application of the ointment.

Premature action in furunculosis was not observed with the experimental ointment. The redevelopment of inflammatory infiltrates without suppuration was not noticed.

In other forms of pyodermia (ecthyma, impetigo) there was also noticed an anti-inflammation and epithelial healing action produced by this experimental ointment. The eroded coverings of impetigo and the deeper abscessed coverings of ecthyma were cleared from pus and suppuration and, on the average of from seven to ten days of treatment with this ointment, were healed.

Conclusions

1. Linseed ointment, in cases of furunculosis and carbunculosis, acts as a strong suppurating (drawing) substance. It shortens the stages of change from inflammatory infiltration to the complete suppuration of pus from furuncles and carbuncles.

2. Thanks to the quick action of this process (in infections of furunculosis and carbunculosis) the average length of incapacity from suppuration of furunculosis and carbunculosis was shortened. In our case this equalled 5-6 days.

3. There is no doubt that a favorable action of the experimental paste is obtained in cases of impetigo and ecthyma of the skin. The paste produces an anti-inflammatory action and promotes rapid epithelialization and knitting together of the elements in cases of impetigo and ecthyma of the skin.

4. The ointment and paste have a more effective action when they contain 20% flaxseed. Ointment and paste containing 10% linseed, although containing the active ingredient, manifest their action much slower.

5. Ointment prepared from a powder of freshly ground flaxseed has a much stronger action than one which has been stored.

Translator's Notice:

The sieve specifications found in this translation are not given in the original Russian article. I have included this data regarding sieves, which is considered as being standard in Russian pharmaceutical practice, as an aid to any retail, hospital, or research pharmacist who may desire to compound the preparations dealt with in this article.

Edgard Yan Allen, M. Sc.

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BOOK REVIEWS

Emulsion Technology—Theoretical and Applied, Second Edition —A Symposium. 360 pages incl. index. Chemical Publishing Co. $6.50.

This book contains a number of papers read at the second Symposium held by the British Section of the International Society of Leather Trades' Chemists and previously published in the book "Technical Aspects of Emulsions" now out of print. In addition, this new volume contains additional data on new emulsifying agents of various types including their manner of use and trade names under which they are available. Also included are a number of technical emulsion formulas and some data on the extensive patent literature in the field.

One weakness of the book is its British accent which from the standpoint of proprietary names and names of equipment manufacturers renders it impractical to the American reader.

Like any compilation of monographs some loss in continuity and some duplication is inevitable, but those interested in emulsions will find in the book useful information even though one is forced to separate the chaff from the wheat.

L. F. T.

Chemistry of Vitamins and Hormones. By S. Rangaswami and T. R. Seshadri. 329 pages incl. index. Andhra University Waltair, South India, 1946. Price Rs. 7-8-0.

This little book was recently sent us from India and we were quite agreeably surprised with its content. Although the expert in the field of vitamin or hormone synthesis would probably find it lacking in detail it is written in a very clear and careful style and its language is excellent.

The authors discuss the chemical constitution of the important vitamins and hormones, giving structural formulas for both the finished product as well as the structures of the more important in-

termediates. An excellent job has been done in correlating the chemical relationship between compounds of similar constitution.

We know of no similar book in the United States written on this subject in a style that is understandable to the average pharmaceutical chemist who frequently needs to refer to the chemistry of these substances. L. F. T.

Chemical Specialties. A Symposium. Compiled by H. Bennett. 826 pages incl. index. Chemical Publishing Co., 1946. Price: $12.50.

The chemical specialty business is a greatly expanding and lucrative field. This book was written for the purpose of teaching the elements of chemistry to the businessman and to provide the essential business information for the chemist. The editor has attempted to present in concentrated form the basic information as compiled from many men who have made a success in this field. Even though the individual has had no formal training in chemistry he can derive a great deal of information from this volume.

Under Compounding Chemistry are presented definitions and physical properties of chemicals. Chemicals are classified according to properties, reactions and uses. Raw materials are discussed in respect to handling, purity, etc.

Very useful information is presented on processing procedure and equipment, two subjects which are always problems to anyone in developing private formulas.

An extensive formulary includes such items as adhesives, cosmetics, emulsions, food products and many others. Directions are given in a clear and simplified style. The development of the desired formula is greatly simplified when there is available a typical formula as a starting-point.

The latter portion of the book presents marketing methods such as the procedure for introducing a product, selling and new product development. General business principles, laws and regulations, records and forms and technical help such as books, trade papers, etc., are discussed.

For anyone who is planning to develop a product in the chemical specialty field this book will be an invaluable aid.

M. O. H.

INDEX TO VOLUME 118 OF THE AMERICAN JOURNAL OF PHARMACY

AUTHOR INDEX, 1946

(B)—Book Review
(E)—Editorial

PAGE

Aliev, R. K.—
New Galenical Preparations From Flax Seeds 439

Allen, Edgard Yan—
New Galenical Preparations From Flax Seeds (A Translation) 439

Arrigoni, Louis; Fischer, Louis; and Sager, Robert W.—
Phytochemical Study of Nereocystis Luetkeana 156

Beal, George D.—
The Age of Research in Science 96

Bortz, Edward L.—
Medicine, Pharmacy and Tomorrow's Health 103

Burlingame, Vera L.; Reddish, George F.; and Wood, Lois B.—
Resistance of Staphylococcus Aureus Cultured in Semi-Synthetic and F. D. A. Media 4

Caspe, Saul—
Mechanism vs. Vitalism 279

PAGE

Cohen, Eugene L.—
Determination of Barbiturates in Toxicological and Clinical Investigations 40

Dodge, A. A.—
An Investigation of Brazilian Sassafras Oil 116
Extractives from Northeastern Woods (B) 411
Lessons in Pharmaceutical Latin and Prescription Writing and Interpretation (B) 410

Fischer, Louis; Sager, Robert W.; and Arrigoni, Louis—
Phytochemical Study of Nereocystis Luetkeana 156

Foter, Milton J.; Quisno, R.; and Gibby, Irvin W.—
A Neutralizing Medium for Evaluating the Germicidal Potency of the Quaternary Ammonium Salts 320

Gershenfeld, Louis—
Harofe Haivri (B) 33

PAGE

Gershenfeld, Louis; and Sagin, Jerome F.—
Synergistic Action of Detergents and Sulfaguanidine and Succinylsulfathiazole .. 228

Gershenfeld, Louis; and Shulik, Saul M.—
Effect of Acetone on the Surface Tension and the Bactericidal Efficiency of Aerosol OT 264

Gibby, Irvin W.; Foter, Milton J.; and Quisno, R.—
A Neutralizing Medium for Evaluating the Germicidal Potency of the Quaternary Ammonium Salts 320

Griffith, Ivor—
Atomic Power and Disease . 137
Birth and Worth of an Inspired Institution (E) 79

Haas, Theodor P.—
Unwanted Plants in the Kilmer Botanical Garden 426

Harding, T. Swann—
The Battle for a Better Food and Drug Act 338
Organizing a Mule 176
Render Unto Caesar 126

Harrisson, Jos. W. E., and Rees, Edward W.—
2, 4-D Toxicity 422

Holland, M. O.—
Chemical Specialties. A Symposium (B) 446
Trends in Modern Medicinals. 192

Johnson, Elof F.—
Rutin and Capillary Fragility . 164

PAGE

Jones, Robert N.—
Uranium and Atomic Power (B) 111

Martin, Gustav J.—
Detoxication of Pentavalent Arsenicals 394

Marshall, Roy K.—
Science Today and Tomorrow 89

Miles, Wyndham—
Sir Kenelm Digby and the Powder of Sympathy 63

Morrison, W. S.—
Uses and Limitations of De-Ionized Water for Pharmaceutical Purposes 236

Quisno, R.; Gibby, Irvin W.; and Foter, Milton J.—
A Neutralizing Medium for Evaluating the Germicidal Potency of the Quaternary Ammonium Salts 320

Reddish, George F.; Wood, Lois B.; and Burlingame, Vera L.—
Resistance of Staphylococcus Aureus Cultured in Semi-Synthetic and F. D. A. Media 4

Rees, Edward W., and Harrisson, Jos. W. E.—
2, 4-D Toxicity 422

Reuning, W.—
German for the Scientist (B). 258

Rosengarten, George—
Fifty Years of Atomic Energy 132

Rubin, N.—
Catalytic Chemistry (B) ... 34

PAGE

Sager, Robert W., Arrigoni, Louis and Fischer, Louis—
Phytochemical Study of Nereocystis Luetkeana 156

Sagin, Jerome F.; and Gershenfeld, Louis—
Synergistic Action of Detergents and Sulfaguanidine and Succinylsulfathiazole .. 228

Shulik, Saul M., and Gershenfeld, Louis—
Effect of Acetone on the Surface Tension and the Bactericidal Efficiency of Aerosol OT 264

Snyder, John M.—
Rodent Control 11

Stoner, W. H.—
Use and Misuse of Hormones. 381

Tice, L. F.—
Amino Acids, Proteins, and Protein Hydrolysates 302
Anesthesia (E) 336
Chemistry of Vitamins and Hormones (B) 445
Emulsion Technology—Theoretical and Applied, Second Edition—A Symposium (B) 445
Food and World Population (E) 380
Glycerin—Its Industrial and Commercial Applications (B) 35
Hayfever Plants (B) 412
Hospital Pharmacy (E) 262
How Many Students (E) .. 154

PAGE

Howell's Textbook of Physiology (B) 34
Cosmetics and Dermatitis (B) 224
Introduction to Emulsions (B) 224
Latin American Relations (E) 226
National Disgrace (E) 38
The National Formulary, Eighth Ed. (B) 417
New Horizons (E) 190
Pharmacy in 1946 (E) 2
Surface Active Agents—Theoretical Aspects and Applications (B) 36
Trade Barriers and our Foreign Drug Markets (E) .. 420
Truth vs. Fiction (E) 300
Warning Statements on Prescriptions (E) 114

Urdang, George—
The Influence of the Quakers on Philadelphia Institutions. 81

Vivian, R. P.—
Medical Problems of Today . 271

Waldbott, Sigmund—
Determination of Alcohol in Galenical Preparations by the Customary Distillation . 324

Wood, Lois B.; Burlingame, Vera L.; and Reddish, George F.—
Resistance of Staphylococcus Aureus Cultured in Semi-Synthetic and F. D. A. Media 4

SUBJECT INDEX, 1946

(A)—Abstract
(B)—Book Review
(E)—Editorial
(S)—Solid Extracts

	PAGE
Acetanilid	371
Acetarsone	397
Acetone	264
Acetylsalicylic Acid	371
Adrenalin Solutions (A)	294
Adrenochrome	215
Aerosol O T	229, 265
Age of Research in Science	96
Air Cargo Potential in Drugs and Pharmaceuticals (B)	258
Alkyl Sulfates (A)	110
Amethone	204
Amigen	212
Amigen Powder	317
Amigen Solution 10%	317
Amino Acids	211, 303
Amino Acids, Proteins, and Protein Hydrolysates	302
Aminoids	212
Aminopyrine	371
Aminonat	212, 318
Aminovite	212, 318
Amiron	212
Amytal	51
Anemone Pulsatilla (A)	330
Anesthesia (E)	336
Anesthesia and Analgesia (A)	408
Antacid Buffers	361
Antimalarials	198
Antithyroid Drugs (A)	250
Arsanilic Acid	395
Artificial Disintegration of Atoms	286
Asthma Inhalant (A)	221
Atabrine Intoxication (A)	184
Atebrin Tablets (A)	221
Atomic Age	106
Atomic Energy	132
Atomic Power and Disease	137
Atropine Substitutes (A)	408
Auditory Impairment Caused by Drugs (A)	184
Autoxidation of Diethyl Ether (A)	252
Bacitracin	216
Barbital	50
Barbiturate Determination	40
Barbiturates in Urine (A)	332
Barometer (S)	150
Barrier Cream (A)	221
Battle for a Better Food and Drug Act, The	338
BCG (S)	187
Benadryl	210
Birth and Worth of an Inspired Institution (E)	70
Brazilian Sassafras Oil	116
Black Widow Spider	131
Buckwheat as a Source of Rutin (A)	146
Buffered Basis for Penicillin Cream (A)	185
Cannabinol (A)	25
Carbon 13	216
Cardigin	194
Catalytic Chemistry (B)	34

	PAGE
Ce-De-Flor	196
Chain Process	289
Chemical Specialties. A Symposium (B)	446
Chemistry of Vitamins and Hormones (B)	445
Chloroquine	198
Cobra Venom (A)	145
Cold Wave (S)	223
Combisul	197
Copeland Bill	350
Copper Ionization Treatment of Fungous Infections (A)	186
Cosmetics and Dermatitis (B)	224
Curare	194, 251, 409
Crystodigin	194
Delcos Granules	318
Delvinal	51
Dental Caries	195
Depot Insulin (A)	222
Desenex	210
Desoxyephedrine	206
Determination of Alcohol in Galenical Preparations by the Customary Distillation	324
Detoxication of Pentavalent Arsenicals	394
Dexedrine	206
Dextro-amphetamine	206
Dextrose (A)	293
Dialkylaminoalkyl Ethers of Stilbestrol and Hexylresorcinol	372
Digby, Sir Kenelm	63
Digitaline Nativelle	193
Digitoxin	193
Digitoxin Assay	360
Dihydroergotamine	203
Distemperoid (S)	150
Drugs by Air Freight (S)	31
Decomposing Fruits and Vegetables (S)	32
Effect of Acetone on the Surface Tension and the Bactericidal Efficiency of Aerosol OT	264
Emergency Sea Suit (S)	150
Emulgen	217
Emulsion Technology—Theoretical and Applied, Second Edition—A Symposium (B)	445
Environmental warmth and its Measurement (B)	259
Enziflur	196
Ephedrine	205
Eserine Sulfate (A)	297
Etheylene Glycol (A)	30
Evaluation of Antipyretics Against Pyrogen-Induced Fever	371
Exotic Diseases (S)	188
Extractives from Northeastern Woods (B)	411
Federal Food, Drug, and Cosmetic Act	338
Fifty Years of Atomic Energy	132
Flax Seeds	439
Fluorine and Dental Caries (A)	295
Fluoros D.	196
Folic Acid	197
Folvite	198
Food and World Population (E)	378
Fungous Infections of Feet (A)	291
Furacin	202
Gelfoam	213
German for the Scientist (B)	256
German Pharmaceutical Formulae (A)	221
Glycerin—Its Industrial and Commercial Applications (B)	35
Glycerine Jelly Base for Penicillin	220
Harofe Haivri (B)	33
Hayfever Plants (B)	412
Hemo-pak	215
Hormones	381
Hospital Admissions (S)	187
Hospital Pharmacy (E)	262
How Many Students (E)	154

	PAGE
Howell's Textbook of Physiology (B)	34
Hydrogen Ion Concentration and Buffer Systems in Ophthalmic Preparations	365
Hydrolysate Products	317
Hyoscine	201
Hypertension (S)	151
Influence of the Quakers on Philadelphia Institutions	81
Influenza Virus Vaccine	192
Intestinal Antiseptic (A)	254
Introduction to Emulsions (B)	224
Investigation of Brazilian Sassafras Oil, An	116
Isomeric Sodium Hydroxymercuribenzoates	370
Isopropyl Alcohol	362
Isotopes	287
Kemithal: A New Hypnotic (A)	406
Khellinin as a Coronary Dilator (A)	329
Kilmer Botanical Garden	426
Lachesine (A)	408
Lactamin	318
Latin American Relations (E)	226
Lessons in Pharmaceutical Latin and Prescription Writing and Interpretation (B)	410
Lithocaine (A)	293
Mechanism vs. Vitalism	279
Medical Problems of Today	271
Medicine, Pharmacy and Tomorrow's Health	103
Melting Point of Acetylsalicylic Acid (A)	332
Meonine	319
Methanol Poisoning (S)	31
Methedrine	206
Methergine	369
Methyl-Thiouracil and Thiouracil as Antithyroid Drugs (A)	250
Microbiotics	216
Mipex (A)	222
Modern Medicinals	192
Monoethanolamine Oleate (A)	293
Morphine Substitutes (A)	408
Mosquito Repellants (A)	222
Motion Sickness	201
Mycocidin (A)	145
National Disgrace (E)	38
National Formulary, Eighth Ed. (B)	416
Neostigmine Methylsulfate and Atropine	131
Nereocystis Luetkeana	156
Neutralizing Medium for Evaluating the Germicidal Potency of the Quaternary Ammonium Salts, A	320
Neutron	288
New Drugs (B)	111
New Galenical Preparations from Flax Seeds	439
New Horizons (E)	190
Nicotinamide Deficiency (A)	406
Nicotinyltaurine (A)	253
Nuclear Fission	286
Nutramigen	212, 317
Nutrisal	203
Oil of Sassafras U. S. P.	116
One Hundred Twenty-fifth Anniversary of the Philadelphia College of Pharmacy & Science	78
Organizing a Mule	176
Oxydrene	206
p-Aminobenzoic Acid	398
Pancreatin	361
Paredrine	369
Parenamine	212, 318
Penicillin	25, 147, 220, 223, 406
Penicillin Cream (A)	149, 407
Penicillin from Various Ointment Bases	364
Penicillins G, X and K (A)	291
Penicillin in Solutions of Ephedrine	365

PAGE

Penicillin in Treatment of Common External Eye Infection (A) 334
Penicillin K 218, 253
Penicillin Lozenges (A) 24
Penicillin Ointments (A) 329
Penicillin Ointments and Creams 363
Penicillin Plants (S) 151
Penicillin Preparations (A) ... 296
Penicillin Recovery (A) 331
Penicillin Solutions (A) 375
Penicillin Stability (A) 328
Penicillin Therapy of Primary Syphilis (S) 188
Pentavalent Arsenicals 394
Pentobarbital 51
Pentothal 50
Perfumery (B) 259
Pervitin 206
Pharmacy in 1946 (E) 2
Phenobarbital 50
Phenol (A) 294
Philadelphia College of Pharmacy and Science 125th Anniversary 78
Phytochemical Study of Nereocystis Luetkeana 156
Pitocin 372
Pitressin 372
Plasmochin Tablets (A) 221
Pneumonia 144
Poisons—Their Chemical Identification and Emergency Treatments (B) 152
Poliomyelitis (S) 151
Polyneuritis Due to Cold (A) . 297
Potentiation of Insulin Hypoglycaemia by Nicotinylaturine (A) 253
Powder of Sympathy 63
Pregnenelone 205
Presinol (A) 222
Promin 201
Propylene Glycol (A) 30
Prostigmine 195

PAGE

Protein Hydrolysate 318
Purodigin 194
Q 176 (S) 150
Quaker Influence 81
Quaternary Ammonium Compounds as Preservatives 366
Quaternary Ammonium Salts .. 322
Quinacrine 199
Quinidine (A) 250
Quinine 199, 293
Radar (S) 32
Radioactive Iodine (S) 187
Radioactive Sodium as Tracer (A) 149
Render Unto Caesar 126
Research 96
Resins (S) 32
Resistance of Staphylococcus Aureus Cultured in Semi-Synthetic and F. D. A. Media (E) 4
Rheumatic Fever (S) 188
Rh Factor (S) 200
Ringworm of the Scalp (A) ... 330
Rodent Control 11
Rutin 146, 215, 418
Rutin and Capillary Fragility .. 164
Sassafras Oil 116
Science and Art of Perfumery, The (B) 259
Science Today and Tomorrow . 89
Scopolamine 201
Seconal 50
Sex Hormones (A) 374
Situation in Switzerland with Regard to Pharmaceutical Specialties, The 242
666 (S) 187
Snake Venom (A) 74
Soap Industry (B) 152
Sodium Chloride (A) 293
Sodium Fluoroacetate 368
Sodium Morrhuate (A) 292
Sodium Salicylate (A) 294
Solution Lead Subacetate N. F. 366

	PAGE
Solvecillin	217
Sopronol	209
Stearns 600	204
Stearns 606	204
Sterilamp (S)	32
Stovarsol	397
Streptobiosamine (A)	28
Streptomyces Antibiotics (A)	28
Streptomycin	151, 217
Streptomycin Degradation (A)	76
Streptomycin in the Treatment of Infections (A)	405
Succinylsulfathiazole	229
Sucrose Synthesis (S)	223
Sulfadiazine and Penicillin	144
Sulfaguanidine	229
Sulfamone	207
2-Sulfanilamido-5-Carboxythiazole (A)	254
Sulfanilyl-guanidine	229
Sulfathalidine	196
Sulfedex	207
Sulfhydryl-containing Substances (A)	373
Sulmefrin	207
Surface Active Agents—Theoretical Aspects and Applications (B)	36
Survival of Coliforms and Enteric Pathogens When Exposed to Chloramine (A)	373
Swiss Pharmacy	243
Sympathomimetic Pressor Amines	369
Synergistic Action of Detergents and Sulfaguanidine and Succinylsulfathiazole	228
Synergistic Action of Penicillin and Mapharsen (A)	72
Synthetic Substitutes for Quinidine (A)	250
TC 6-A	114
TDE (A)	109
Tergitol 08	229
Tergitol 4	229
Tergitol 4T	229
Tetanus (S)	31
Thiouracil	114, 250
Thiouracil Toxicity (A)	148
Thizodrin	207
Thrombin	213
Thrombin in Surgery (A)	333
Thyroxine	398
Toxicity of Streptomycin for Man (A)	183
Trade Barriers and our Foreign Drug Markets (E)	420
Trends in Modern Medicinals	192
Tridione	204, 404
Triton K-12	229
Tropical Diseases (S)	188
Truth vs. Fiction (E)	300
2,4-D Toxicity	422
U 235	135
Unwanted Plants in the Kilmer Botanical Garden	426
Uranium	135
Uranium and Atomic Power (B)	111
Urethane (A)	293
Use and Misuse of Hormones	381
Useful Preparations (A)	108
Uses and Limitations of De-Ionized Water for Pharmaceutical Purposes	236
Varicose Vein Sclerosing Agents (A)	292
Veterinary-grade Petrolatum (S)	31
Viburnum	367
Viburnum Leaves	367
Vigantol Dragees (A)	222
Vitamin K in Chewing Gum	131
Warning Statements on Prescriptions (E)	114
Weed Killer (S)	223

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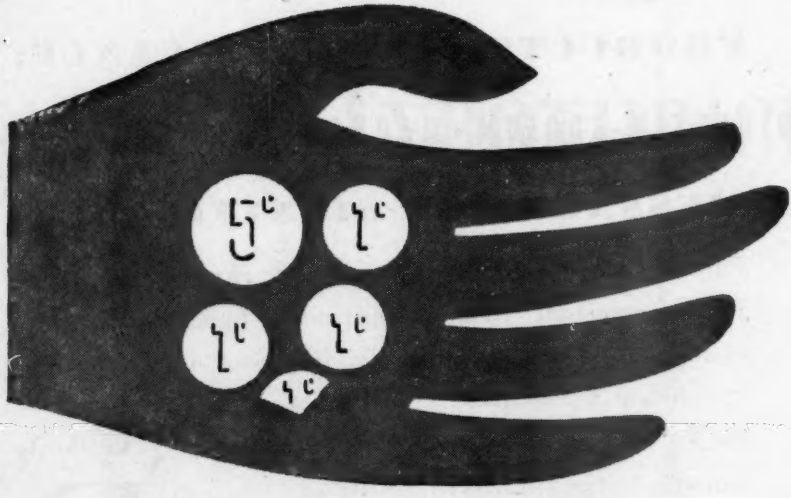

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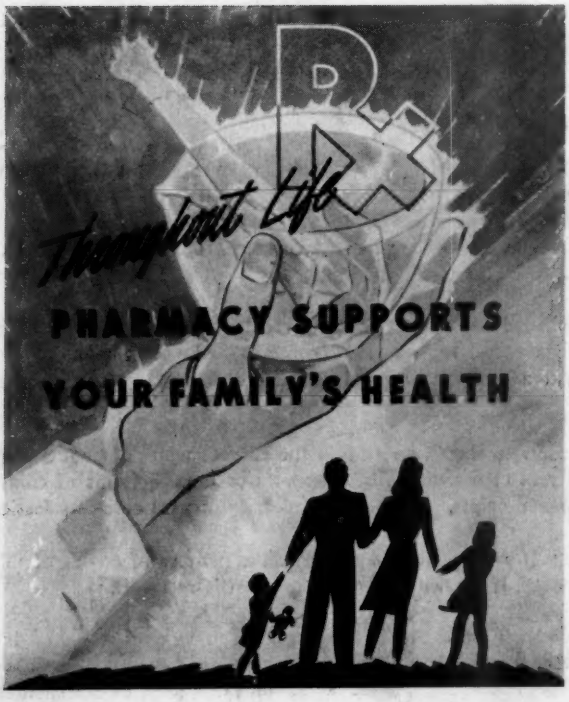
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